



EPA Region 7 TMDL Review

TMDL ID: KS-KLR-02-238-39

Waterbody ID: KS-KLR-02-238_40, KS-KLR-02-238_394, KS-KLR-02-238_41, KS-KLR-04-238_106

Waterbody Name: Shunganunga Creek

Tributary: Stinson Creek, Deer Creek, S. Br. Shunganunga Creek

Pollutant: DISSOLVED OXYGEN

State: KS

HUC: 10270102

BASIN: Kansas/Lower Republican Basin

Submittal Date: February 11, 2007

Approved: Yes

Submittal Letter

State submittal letter indicates final TMDL(s) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act.

The TMDL for Shunganunga Creek Watershed was formally submitted by Kansas Department of Health and Environment (KDHE) in a letter received by United States Environmental Protection Agency (EPA) on December 11, 2006. The public comments and KDHE's response to those comments were formally submitted by KDHE in a letter received by EPA on January 9, 2007. Revisions to Shunganunga Creek Watershed TMDL were submitted by email February 26, 2007.

Water Quality Standards Attainment

The water body's loading capacity for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards.

The TMDL for this watershed is a continuum of desired loads over all flow conditions, rather than fixed at a single value.

The impairment due to low Dissolve Oxygen (DO) is being addressed by targeting the load of Biological Oxygen Demand (BOD) at critical flows of less than 3.74 cfs. The BOD target is identified using a reference stream approach to anticipate DO levels while it measures the total concentration of DO that will be demanded as organic matter degrades in a stream. Load curves were established for the DO Aquatic Life criterion by multiplying the estimated flow values for Shunganunga Creek by the applicable water quality criterion and converting the units to derive a load duration curve of pounds of DO per day. The reduction of BOD called for in the TMDL is adequate to achieve water quality standards (WQS) of 5 mg/L DO.

Numeric Target(s)

Submittal describes applicable water quality standards, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.

Designated Uses: Expected Aquatic Life Support, Primary Contact Recreation B and C, Domestic Water Supply, Food Procurement, Groundwater Recharge, Industrial Water Supply, Irrigation Use, and Livestock Watering for Main Stem Segment and tributary S. Br Shunganunga Creek. Other tributary uses are the same, except recreation use for Stinson Creek is Secondary Contact b and Deer Creek is Primary Contact C.

Impaired Use: Expected Aquatic Life Support

WQS: Dissolved Oxygen (DO): 5 mg/L (KAR 28-16-28e(c)(2)(A))

The ultimate endpoint for this TMDL will be to achieve the Kansas WQS fully supporting Aquatic Life, indicated by DO concentrations of 5 mg/L or more. The lack of consistent flow will aggravate situations of deficient DO, particularly at flows below mean flow.

Numeric Target(s) and Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety that do not exceed the load capacity.

DO is significantly correlated with streamflow, fluoride and selenium and inversely correlated with ammonia and total phosphorus. Though not significant, DO was also negatively correlated with parameters typically associated with runoff (BOD, fecal coliform, fecal strep and total suspended solids) as well as water temperature. The target BOD levels were established by the multiple regression model and are based upon established relationship between DO and BOD, stream temperature, pH and total suspended solids.

Source Analysis

Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, non point and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

Land Use: The Shunganunga Creek Watershed is urban land and grassland (47.5 and 28.5% of the area, respectively) and cropland (17.5%). Much of the urban land is located along the main stem for most of the watershed. According to the NRCS Riparian Inventory, there are approximately 5,350 acres of riparian area in the watershed, most of which is categorized as forest land (34%), crop/tree mix (18%), cropland (13%), pasture/tree mix (8%), pasture land (6%) and shrub/scrub land (4%). Summing those riparian categories with a tree/shrub component shows that two-third of late Summer/Fall, which can lead to DO excursions driven by the decomposition of leaves in the stream under these conditions. However, the more pervasive threat will be urban stormwater. The watershed population density is high (845 person/sq mi) when compared to densities elsewhere in the Kansas Lower Republican Basin. Failing on-site waste systems can contribute oxygen demanding substance loadings and their impact on the impaired segment may be of importance, given the lack of other sources in the watershed. Some organic enrichment may be associated with environmental backgrounds levels, including contributions from wildlife and stream side vegetation.

On Site Waste Systems: The watershed population density is high (845 persons/sq mi) when compared to densities elsewhere in the Kansas/Lower Republican Basin. The rural population projection for Shawnee County through 2020 shows a marked increase of about 40%. Based on 1990 census data about 13.5% of households in Shawnee County are on Septic systems. Failing on site waste systems can contribute oxygen demanding substances loadings and their impact on the impaired segment may be of importance, given the lack of other sources in the watershed.

There are two active NPDES municipal permitted dischargers (Shawnee Hills Mobile Homes WWTP C-KS72-0011 and Sherwood Improvement District M-KS72-0027) within the Shunganunga Creek watershed, both of which could contribute an organic/nutrient substance load to monitoring site in the watershed. Point sources are responsible for maintaining their systems in proper working condition and appropriate capacity to handle anticipated wasteloads of their respective populations. Ongoing inspections and monitoring of the systems will be made to ensure that minimal contributions have been made by this source.

The Sherwood improvement district relies on a mechanical system (activated sludge) for the treatment of their waste water. Monthly effluent monitoring reports since 1999 indicate the plant has always been well below their BOD permit limits. The maximum BOD from their reports was 10 mg/l and the average BOD for the same period was 3.9 mg/l. The plant was upgraded and placed online in July 2003. Recent data indicate the plant discharges about 1 MGD and under 2 mg/L BOD. Due to the plant remaining well below BOD permit limits that already protect DO criteria in Shunganunga Creek; this system cannot be considered a cause of the DO problem in the watershed.

The Shawnee Hills Mobile Home WWTP uses an aerated three cell lagoon system for the treatment of their wastewater. Monthly effluent monitoring reports since 1999 indicate the plant is usually below their BOD limits. The plant discharges BOD of 29-32 mg/l and during this time period the facility exceeded their BOD limit about 25% of the time. Despite this, Streeter-Phelps analysis indicates that the current permit limit maintains DO levels above 5.0 mg/l in Shunganunga Creek. The stream segment profile of DO from the confluence of the two wastewater discharges is displayed in Appendix A of the TMDL.

The East Side Baptist Church (KSJ000183) facility has non-discharging one cell lagoon systems that may contribute a oxygen demanding substance load to Shunganunga Creek under extreme precipitation events (stream flows associated with such events are typically exceeded only 1-5% of the time).

There's one confined animal feeding operation (A-KSSN-M003) within the watershed. Despite their proximity to the creek, they are certified not to cause significant pollution to the stream except in situations of extreme precipitation events (stream flows associated with such events are typically exceeded only 1-5% of the time).

The Meier's Ready mix south Plant (KSG460028) and 21st St. Plant (KSG110130) are non-discharging facilities. The facility is a permanent central mix batch concrete plant. Wastewater is generated by washing the inside of the truck mixer drums and the outside of the trucks (stream flows associated with such events are typically infrequent, see Appendix B).

Submittal demonstrates all significant sources have been considered.

Allocation

Submittal identifies appropriate wasteload allocations for point, and load allocations for nonpoint sources. If no point sources are present the wasteload allocation is zero. If no nonpoint sources are present, the load allocation is zero.

Lack of sufficient DO is caused by a combination of organic materials into Shunganunga Creek, mostly under warm water temperatures and with insufficient flow to either dilute the organic material or to provide re-aeration to the stream.

WLA Comment

Based upon the preceding assessment, only the discharging point sources (Sherwood Regional WWTP and Shawnee County MHP) contributing a BOD load in the Shunganunga Creek watershed upstream will be considered in this WLA.

The Shawnee Co. MHP BOD permit limit is 30 mg/l. Sherwood Regional WWTP BOD limit varies by month based upon expected ambient stream temperatures and ranges from 20 mg/l during July and August to 30 mg/l for October through April. Streeter-Phelps analysis performed for the warmest stream temperature conditions for both point sources indicate the present BOD permit limit for these point sources maintain DO levels above 5 mg/l in the stream when there is no flow upstream of either discharge point.

The sum of the design flows of the point sources (3.74 cfs) redefines the lowest flow seen (85-99% exceedance), and the WLA (combined) equals the TMDL curve across this flow condition (see figure 23 in the TMDL). Using the Streeter-Phelps model the "warm" season WLA for Shawnee Co. MHP is 3.8 lbs/day BOD, which translate to an in-stream WLA of 0.27 lbs/day BOD.

For the Sherwood facility, using the warmest stream temperatures as a conservative condition, the WLA is 400.6 lbs/day, which translates to an in stream WLA of 42.1 lbs/day.

No DO excursions exist for those samples collected during the defined Winter season. Because of this, the BOD target for these cooler stream temperature conditions differs from that of the warm stream temperature BOD target. This "cool" season BOD target is 4.8 mg/L.

The WLA for Shawnee Co. MHP remains at 3.8 lbs/day BOD but the WLA on Shunganunga Creek now translates to an in-stream value of 0.62 lbs/day BOD at the "cool" season target.

The Sherwood facility's WLA is 1,051.6 lbs/day BOD based on their higher BOD permit limit of 30 mg/L during the Winter season. This translates into an in-stream WLA of 96.1 lbs/day BOD.

All permitted livestock facilities (CAFOs) are non-discharging permits. The WLAs are set at zero (see Appendix B).

The East Side Baptist Church (KSJ000183) facility has non-discharging one cell lagoon systems that may contribute a oxygen demanding substance load to Shunganunga Creek under extreme precipitation events (stream flows associated with such events are typically exceeded only 1-5% of the time). The WLA is zero.

Appendix B lists the permitted facilities in the Shunganunga watershed; Meier's Ready mix south Plant and Meier's Ready mix 21st St. Plant are non-discharging facilities. These facilities have WLAs of zero.

LA Comment

Based on the prior assessment of sources, the distribution of excursions from WQS at site 238 and the relationship of those excursions to temperature conditions and seasons, non-point sources are seen as a contributing factor to the DO excursions in the watershed.

The LA assigns responsibility for meeting the seasonal in stream BOD target levels (warm season BOD target = 2.1 mg/L; cool season = 4.8 mg/L) as site 238 for flows greater than 3.74 cfs (0-85% exceedance). The LA equals zero for flows from 0-3.74 cfs (85-99% exceedance), since the flow at this condition is entirely effluent created, and then increases above the WLA/LA demarcation line to the TMDL curve with increasing flows above 3.74 cfs. The Load Duration Curve is found in figure 23 in the TMDL.

Available data for Shunganunga Creek shows an instance where load exceeds the TMDL; therefore an explicit 10% MOS is assigned to this TMDL. For example, LA at 60% the TMDL is approximately 100 pounds per day.

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided.

The MOS is explicit and based on a target DO of 5.5 mg/L (for an explicit 10% MOS) and the result yielded a Winter Biological Oxygen Demand (BOD) target of 4.8 mg/L at Site 238, rather than the 5.0 mg/L criterion.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

Seasonal variation is accounted for by this TMDL, since the TMDL endpoint is sensitive to stream temperature, with the highest temperatures usually occurring the Spring and Summer-Fall seasons.

This is a staged TMDL. Additional monitoring over time will be needed to ascertain the relationship of organic loadings to DO during the critical seasons of concern.

Public Participation

Submittal describes public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s).

Public Notice: Public notification of the second round of TMDLs in Kansas-Lower Republican Basin was made in the Kansas Register in January 5, 2006. An active Internet Web site was established at <http://www.kdheks.gov/tmdl/> to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Lower Republican Basin. Comments on the draft TMDL were received by the City of Topeka.

Public Hearing: Public Hearings on the second round of TMDLs of the Kansas-Lower Republican Basin were held in Olathe on January 19 and in Topeka on January 30, 2006.

Basin Advisory Committee: The Kansas-Lower Republican Basin Advisory Committee met to discuss the second round of TMDLs in the basin on April 7, 2005 in Lawrence, July 26, 2005 in Concordia, October 20, 2005 in Lawrence and January 24, 2006 in Topeka.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies the monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used).

KDHE will continue to collect bimonthly samples at Station 238 IN 2006-2011 including DO samples, in order to assess progress and success in implementing this TMDL toward reaching its endpoint. Should impaired status remain, the desired endpoints under this TMDL will be refined and more intensive sampling may need to be conducted under specified lower flow conditions over the period 2010-2014. Use of the real time flow data available at the Solider Creek (USGS Station 0688950) stream gaging station can help direct these sampling efforts.

Reasonable assurance

Reasonable assurance only applies when reductions in nonpoint source loading is required to meet the prescribed waste load allocations.

Reasonable assurances are not required. Street-Phelps analysis shows the WLAs to be protective.